MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

BQT1614 – QUANTITATIVE ANALYSIS

(All sections / Groups)

25 OCTOBER 2017
9.00 am – 12.00pm
(3 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **ELEVEN (11)** printed pages with **FIVE (5)** questions.
2. Answer **ALL** five questions in the answer booklet provided.
3. Students are allowed to use non-programmable scientific calculators only.
4. Marks are shown at the end of each question.

Question 1

(a) The following data give the time (in minutes) that each of 16 students waited in line at the bookstore to pay for their textbooks in the beginning of trimester 3' 2016/2017.

15	8	23	21	5	17	31	22
5	10	14	17	16	25	30	3

i) Determine the mean and standard deviation of time for the students to wait in line to pay their textbooks.

[2 marks]

ii) Determine the median of time for the students to wait in line to pay their textbooks. Interpret your answer.

[3 marks]

iii) Determine the shape of time for the students to wait in line to pay their textbooks. Interpret your answer.

[3 marks]

(b) The following lists the probability distribution of the number of potential weapons detected by a metal detector at an airport on a given day.

x	0	1	2	3	4	5
$P(x)$	0.14	0.28	0.22	0.18	0.12	0.06

i) Find the probability of at least two potential weapons detected by a metal detector at the airport on a given day.

[2 marks]

ii) Determine the expected number of potential weapons detected by a metal detector at the airport on a given day.

[2 marks]

iii) Determine the variance of the number of potential weapons detected by a metal detector at the airport on a given day.

[4 marks]

iv) Calculate Var (X^2). [4 marks]

[Total = 20 Marks]

Continued...

Question 2

(a) Spoke Weaving Corporation has eight weaving machines of the same kind and of the same age. The probability is 0.04 that any weaving machine will break down at any time.

i) Find the probability none of the weaving machines will be broken down.

[2 marks]

ii) Find the probability of at most two weaving machines will be broken down.

[5 marks]

iii) Find the probability of five weaving machines to function properly.

[3 marks]

(b) Judy works at a company located at Petaling Jaya. She knows that the time it takes for her to travel from home to work is normally distributed with a mean of 40 minutes and standard deviation of 5.5 minutes. She leaves home by 7.45am every morning.

i) What is the probability that she will reach office after 8.30am?

[3 marks]

ii) What is the probability that she will be in office between 8.15am to 8.40am?

[4 marks]

iii) Working hour starts at 9am and the HR will issue a warning letter for employee to be late for work. Find the probability that Judy will be issued a warning letter.

[3 marks]

[Total = 20 Marks]

Question 3

a) The management of the Seaside Golf Club regularly monitors the golfers on its course for speed of play. Suppose a random sample of golfers was taken in 2015 and another random sample of golfers was selected in 2016. The results of the two samples are as follows:

2015	**2016**
$\bar{x}_1 = 213$	$\bar{x}_2 = 219$
$S_1 = 20.25$	$S_2 = 21.7$
$n_1 = 36$	$n_2 = 31$

Continued.....

Based on the sample results, can the management of the Seaside Golf Club conclude that average speed of play was different in 2016 than in 2015? Conduct the appropriate hypothesis test at the 0.10 level of significance. Assume that the management of the club is willing to accept the assumption that the population of playing times for each year are approximately normally distributed with equal variances.

[12 marks]

b) Of a random sample of 545 accountants engaged in preparing county operating budgets for use in planning and control, 117 indicated that estimates of cash flow were the most difficult element of the budget to derive. At 5% significance level, is there is any evidence to conclude that at least 25% of all accountants find cash flow the most difficult estimates to derive?

[8 marks]

[Total = 20 Marks]

Question 4

A shipping company believes that the variation in the cost of a customer's shipment can be explained by differences in the weight of the package being shipped. To investigate this, a random sample of 15 customer shipments was selected, and the weight (in lb) and the cost ($) for each shipment were recorded. The following results were obtained:

Weight(lb)	Cost ($)
8	11
6	8
5	11
7	11
12	17
9	11
17	27
13	16
8	9
18	25
17	21
17	24
10	16
20	24
9	21

Continued.....

a) Identify the independent variable and the dependent variable. [2 marks]
b) Compute the coefficient of correlation and interpret its value. [5 marks]
c) Compute the coefficient of determination and interpret. [3 marks]
d) Determine the Least Square regression equation. [5 marks]
e) Interpret the meaning of the slope. [2 marks]
f) For a shipping with 22lb weight,, estimate the cost and comment on the accuracy of the estimate. [3 marks]

[Total = 20 Marks]

Question 5

(a) The following table shows the quantities purchased for three types of junk food in the year 2007 and 2017, and the prices paid for them.

Items	2007		2017	
	Price (RM)	**Quantity**	**Price (RM)**	**Quantity**
A	$7.60	12	$8.15	10
B	3.05	8	3.30	9
C	2.15	25	2.30	33

i) Determine the Paasche price index for 2017 using 2007 as the base period. Interpret the values.

[4 marks]

ii) Determine the value index.

[2 marks]

b) Suppose that $700 amounted to $801.06 in a savings account after two years. If interest was compounded quarterly, find the nominal rate of interest, compounded quarterly, that was earned by the money.

[3 marks]

c) A debt of $5000 due in five years is to be repaid by a payment of $2000 now and a second payment at the end of six years. How much should the second payment be if the interest rate is 6 % compounded quarterly?

[3 marks]

Continued.....

d) An ordinary annuity pays 7.44% compounded monthly.

(i) An individual deposits $100 monthly for 30 years and then makes equal monthly withdrawals for the next 15 years, reducing the balance to zero. What are the monthly withdrawals? How much interest is earned during the the entire 45 year process? [5 marks]

(ii) If the individual wants to make withdrawals of $2000 per month for the last 15 years, how much must be deposited monthly for the first 30 years?

[3 marks]

[Total = 20 Marks]

End of Questions

STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Mean $(\bar{x}) = \dfrac{\sum_{i=1}^{n} X_i}{n}$

Standard Deviation $(s) = \sqrt{\dfrac{\sum_{i=1}^{n} X_i^2}{n-1} - \dfrac{(\sum_{i=1}^{n} X_i)^2}{n(n-1)}}$

Coefficient of Variation $(CV) = \dfrac{\sigma}{\bar{X}} \times 100$

Pearson's Coefficient of Skewness $(S_k) = \dfrac{3(\bar{X} - Median)}{s}$

B. PROBABILITY

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A)× P (B) if A and B are independent

P (A | B) = P (A and B) ÷ P (B)

Poisson Probability Distribution

If X follows a Poisson Distribution , $P(\lambda)$ where $P(X = x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$

then the mean = $E(X) = \lambda$ and variance = $VAR(X) = \lambda$

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = $E(X) = np$ and variance = $VAR(X) = npq$ where $q = 1 - p$

Normal Distribution

If X follows a Normal distribution, $N(\mu, \sigma)$ where $E(X) = \mu$ and $VAR(X) = \sigma^2$

then $Z = \dfrac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

$(100-\alpha)$ % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$ $(100-\alpha)$% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\left(s/\sqrt{n}\right)$
$(100-\alpha)$% Confidence Interval for Population Proportion = $\pi = p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$
Sample Size Determination for Population Mean $= n \geq \left[\frac{(Z_{\alpha/2})\sigma}{E}\right]^2$ Sample Size Determination for Population Proportion = $n \geq \frac{Z^2 \times p(1-p)}{E^2}$ Where E = Limit of Error in Estimation

D. HYPOTHESIS TESTING

One Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x}-\mu}{s/\sqrt{n}}$
One Sample Proportion Test	
$Z = \frac{p-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$	
Two Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$z = \frac{(\overline{x}_1-\overline{x}_2)-(\mu_1-\mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$	$t = \frac{(\overline{x}_1-\overline{x}_2)-(\mu_1-\mu_2)}{\sqrt{S_p^2\left(1/n_1 + 1/n_2\right)}}$ where $S_p^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{(n_1+n_2-2)}$
Two Sample Proportion Test	
$Z = \frac{(p_1-p_2)-(\pi_1-\pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ where $\bar{p} = \frac{X_1+X_2}{n_1+n_2}$; $p_1 = \frac{X_1}{n_1}$; $p_2 = \frac{X_2}{n_2}$ *where X_1 and X_2 are the number of successes from each population*	

E. REGRESSION ANALYSIS

Simple Linear Regression
$Y_i = \beta_0 + \beta_1 X_1 + \varepsilon_i$ Where $\beta_0 = \overline{Y} - \beta_1 \overline{X}$ and $\beta_1 = \dfrac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\left[\sum X^2 - \left((\sum X)^2 / n\right)\right]}$
Correlation Coefficient
$r = \dfrac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\sqrt{\left[\sum X^2 - \left((\sum X)^2 / n\right)\right]\left[\sum Y^2 - \left((\sum Y)^2 / n\right)\right]}} = \dfrac{COV(X,Y)}{\sigma_X \sigma_Y}$

F. INDEX NUMBERS

Simple Price Index $P = \dfrac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \dfrac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Aggregate Price Index $P = \dfrac{\sum p_t}{\sum p_0}(100)$	**Paasche Quantity Index** $P = \dfrac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \dfrac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(Laspeyres\ Price\ Index)(Paasche\ Price\ Index)}$
Paasche Price Index $P = \dfrac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \dfrac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

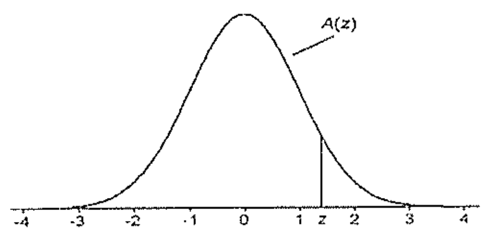
G. FINANCIAL MATHEMATICS

Simple Interest $I = Pnr$ $A = P(1 + nr)$	**Compounded Interest** $I_t = P[(1+i)^n - 1]$ $A_t = P(1+i)^n$
Effective Rate of Interest $r_{\text{effective}} = \left(1 + \dfrac{r}{m}\right)^m - 1$	**Sinking Fund** $S = R\left[\dfrac{(1+i)^n - 1}{i}\right]$

Future Value	**Present Value**
$A_t = P(1+i)^n$	$P = A(1+i)^{-n}$
Future Value of an Annuity $FV_A = R\left[\frac{(1+i)^n - 1}{i}\right]$	**Present Value of an Annuity** $PV_A = R\left[\frac{1-(1+i)^{-n}}{i}\right]$
Amortization $R = \left[\frac{P(i)}{1-(1+i)^{-n}}\right]$	

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

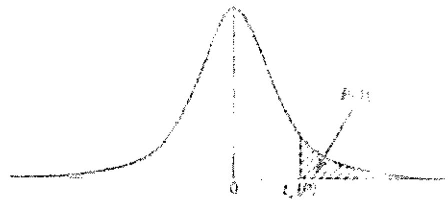
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

TABLE 10. PERCENTAGE POINTS OF THE t-DISTRIBUTION

This table gives percentage points $t_\nu(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{\nu\pi}} \frac{\Gamma(\frac{1}{2}\nu+\frac{1}{2})}{\Gamma(\frac{1}{2}\nu)} \int_{t_\nu(P)}^{\infty} \frac{dt}{(1+t^2/\nu)^{\frac{1}{2}(\nu+1)}}.$$

Let X_1 and X_2 be independent random variables having a normal distribution with zero mean and unit variance and a χ^2-distribution with ν degrees of freedom respectively; then $t = X_1/\sqrt{X_2/\nu}$ has Student's t-distribution with ν degrees of freedom, and the probability that $t \geqslant t_\nu(P)$ is $P/100$. The lower percentage points are given by symmetry as $-t_\nu(P)$, and the probability that $|t| \geqslant t_\nu(P)$ is $2P/100$.



The limiting distribution of t as ν tends to infinity is the normal distribution with zero mean and unit variance. When ν is large interpolation in ν should be harmonic.

P	40	30	25	20	15	10	5	2·5	1	0·5	0·1	0·05
$\nu = 1$	0·3249	0·7265	1·0000	1·3764	1·963	3·078	6·314	12·71	31·82	63·66	318·3	636·6
2	0·2887	0·6172	0·8165	1·0607	1·386	1·886	2·920	4·303	6·965	9·925	22·33	31·60
3	0·2767	0·5844	0·7649	0·9785	1·250	1·638	2·353	3·182	4·541	5·841	10·21	12·92
4	0·2707	0·5686	0·7407	0·9410	1·190	1·533	2·132	2·776	3·747	4·604	7·173	8·610
5	0·2672	0·5594	0·7267	0·9195	1·156	1·476	2·015	2·571	3·365	4·032	5·893	6·869
6	0·2648	0·5534	0·7176	0·9057	1·134	1·440	1·943	2·447	3·143	3·707	5·208	5·959
7	0·2632	0·5491	0·7111	0·8960	1·119	1·415	1·895	2·365	2·998	3·499	4·785	5·408
8	0·2619	0·5459	0·7064	0·8889	1·108	1·397	1·860	2·306	2·896	3·355	4·50	5·041
9	0·2610	0·5435	0·7027	0·8834	1·100	1·383	1·833	2·262	2·821	3·250	4·297	4·781
10	0·2602	0·5415	0·6998	0·8791	1·093	1·372	1·812	2·228	2·764	3·169	4·144	4·587
11	0·2596	0·5399	0·6974	0·8755	1·088	1·363	1·796	2·201	2·718	3·106	4·025	4·437
12	0·2590	0·5386	0·6955	0·8726	1·083	1·356	1·782	2·179	2·681	3·055	3·930	4·318
13	0·2586	0·5375	0·6938	0·8702	1·079	1·350	1·771	2·160	2·650	3·012	3·852	4·221
14	0·2582	0·5366	0·6924	0·8681	1·076	1·345	1·761	2·145	2·624	2·977	3·787	4·140
15	0·2579	0·5357	0·6912	0·8662	1·074	1·341	1·753	2·131	2·602	2·947	3·733	4·073
16	0·2576	0·5350	0·6901	0·8647	1·071	1·337	1·746	2·120	2·583	2·921	3·686	4·015
17	0·2573	0·5344	0·6892	0·8633	1·069	1·333	1·740	2·110	2·567	2·898	3·646	3·965
18	0·2571	0·5338	0·6884	0·8620	1·067	1·330	1·734	2·101	2·552	2·878	3·610	3·922
19	0·2569	0·5333	0·6876	0·8610	1·066	1·328	1·729	2·093	2·539	2·861	3·579	3·883
20	0·2567	0·5329	0·6870	0·8600	1·064	1·325	1·725	2·086	2·528	2·845	3·552	3·850
21	0·2566	0·5325	0·6864	0·8591	1·063	1·323	1·721	2·080	2·518	2·831	3·527	3·819
22	0·2564	0·5321	0·6858	0·8583	1·061	1·321	1·717	2·074	2·508	2·819	3·505	3·792
23	0·2563	0·5317	0·6853	0·8575	1·060	1·319	1·714	2·069	2·500	2·807	3·485	3·768
24	0·2562	0·5314	0·6848	0·8569	1·059	1·318	1·711	2·064	2·492	2·797	3·467	3·745
25	0·2561	0·5312	0·6844	0·8562	1·058	1·316	1·708	2·060	2·485	2·787	3·450	3·725
26	0·2560	0·5309	0·6840	0·8557	1·058	1·315	1·706	2·056	2·479	2·779	3·435	3·707
27	0·2559	0·5306	0·6837	0·8551	1·057	1·314	1·703	2·052	2·473	2·771	3·421	3·690
28	0·2558	0·5304	0·6834	0·8546	1·056	1·313	1·701	2·048	2·467	2·763	3·408	3·674
29	0·2557	0·5302	0·6830	0·8542	1·055	1·311	1·699	2·045	2·462	2·756	3·396	3·659
30	0·2556	0·5300	0·6828	0·8538	1·055	1·310	1·697	2·042	2·457	2·750	3·385	3·646
32	0·2555	0·5297	0·6822	0·8530	1·054	1·309	1·694	2·037	2·449	2·738	3·365	3·622
34	0·2553	0·5294	0·6818	0·8523	1·052	1·307	1·691	2·032	2·441	2·728	3·348	3·601
36	0·2552	0·5291	0·6814	0·8517	1·052	1·306	1·688	2·028	2·434	2·719	3·333	3·582
38	0·2551	0·5288	0·6810	0·8512	1·051	1·304	1·686	2·024	2·429	2·712	3·319	3·566
40	0·2550	0·5286	0·6807	0·8507	1·050	1·303	1·684	2·021	2·423	2·704	3·307	3·551
50	0·2547	0·5278	0·6794	0·8489	1·047	1·299	1·676	2·009	2·403	2·678	3·261	3·496
60	0·2545	0·5272	0·6786	0·8477	1·045	1·296	1·671	2·000	2·390	2·660	3·232	3·460
120	0·2539	0·5258	0·6765	0·8446	1·041	1·289	1·658	1·980	2·358	2·617	3·160	3·373
∞	0·2533	0·5244	0·6745	0·8416	1·036	1·282	1·645	1·960	2·326	2·576	3·090	3·291

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